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Jha et al.

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(54) APPARATUS AND METHODS FOR DETECTION AND MANAGEMENT OF UNAUTHORIZED EXECUTABLE INSTRUCTIONS ON A WIRELESS DEVICE

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(51) **Int. Cl.**

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G07D 11/00	(2006.01)
G07F 19/00	(2006.01)

(52) **U.S. Cl.** **235/379**; 235/472.02

(58) **Field of Classification Search** 235/379, 235/375, 487, 383, 472.02; 705/7–8
See application file for complete search history.

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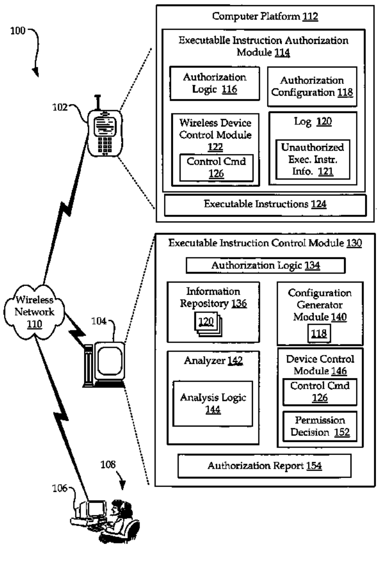
(57) ABSTRACT

Detection and management methods and apparatus for wireless devices may include an executable instruction authorization module operable to scan executable instructions on a wireless device, generate a log indicative of a virus or otherwise unauthorized executable instructions based on a received authorization configuration, and forward the log to a user manager. The user manager may be operable to analyze the log and generate an authorization report which may be viewable by an operator to determine the disposition of unauthorized executable instructions. At least one of the executable instruction authorization module, the user manager, and the operator may be operable to generate a control command operable to delete, or otherwise disable, unauthorized executable instructions on the wireless device, or to restore the executable instructions on the wireless device.

52 Claims, 9 Drawing Sheets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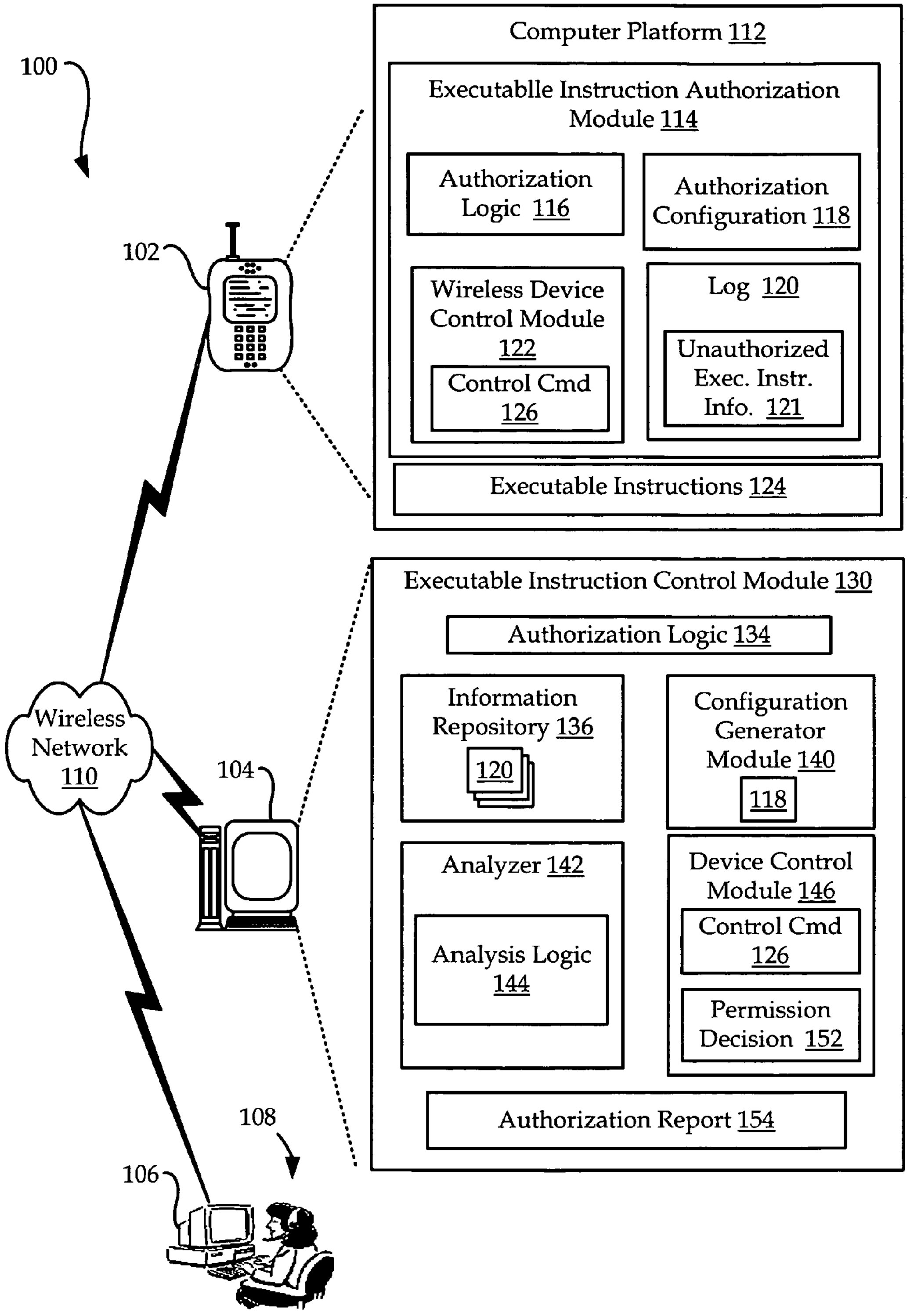
102
Computer Platform 112
Executablle Instruction Authorization Module 114
Authorization Logic 116
Authorization Configuration 118
Wireless Device Control Module 122
Control Cmd 126
Log 120
Unauthorized Exec. Instr. Info. 121
Executable Instructions 124
Wireless Network 110
104
Executable Instruction Control Module 130
Authorization Logic 134
Information Repository 136
120
Configuration Generator Module 140
118
Analyzer 142
Analysis Logic 144
Device Control Module 146
Control Cmd 126
Permission Decision 152
Authorization Report 154
108
106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Computer Platform 112
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Authorization Logic 116
Authorization Configuration 118
Wireless Device Control Module 122
Control Cmd 126
Log 120
Unauthorized Exec. Instr. Info. 121
Executable Instructions 124
Executable Instruction Control Module 130
Authorization Logic 134
Information Repository 136
120
Configuration Generator Module 140
118
Analyzer 142
Analysis Logic 144
Device Control Module 146
Control Cmd 126
Permission Decision 152
Authorization Report 154
Wireless Network 110
104
108
106

Fig. 1

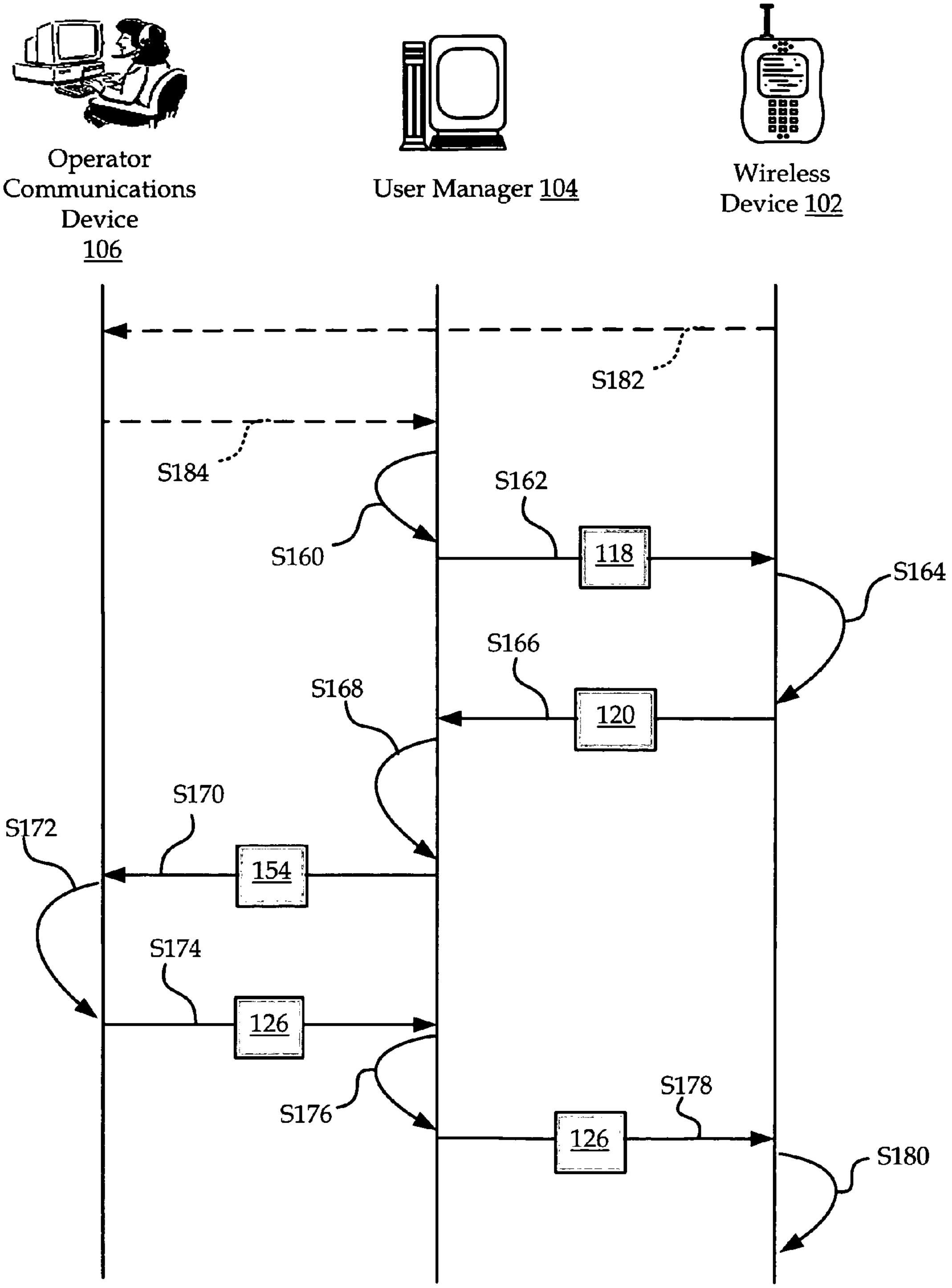

Operator Communications Device 106
User Manager 104
Wireless Device 102
S182
S184
S162
118
S160
S164
S166
120
S168
S170
S172
154
S174
126
S176
S178
126
S180

Fig. 2

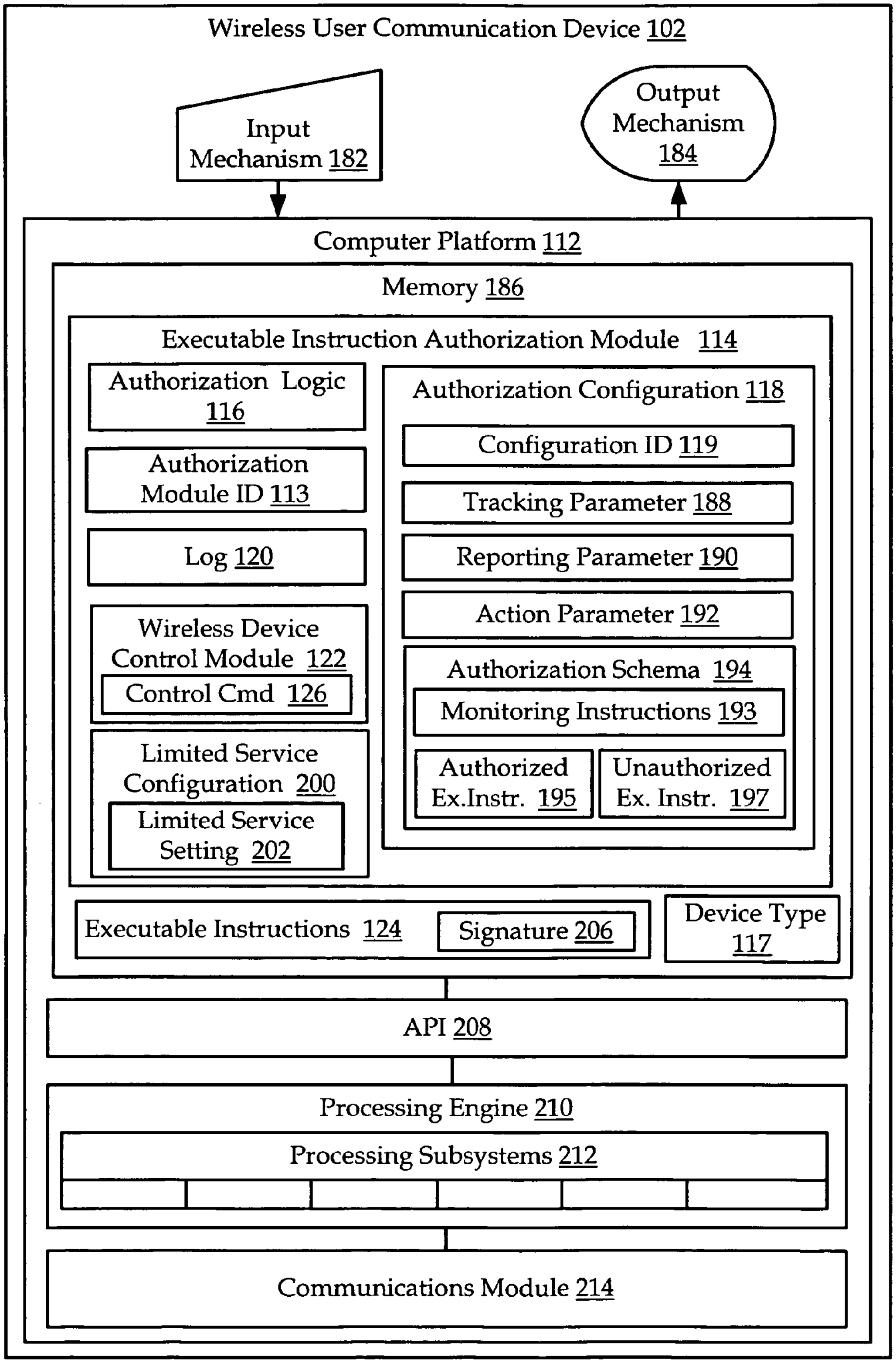

Wireless User Communication Device 102
Input Mechanism 182
Output Mechanism 184
Computer Platform 112
Memory 186
Executable Instruction Authorization Module 114
Authorization Logic 116
Authorization Module ID 113
Log 120
Wireless Device Control Module 122
Control Cmd 126
Limited Service Configuration 200
Limited Service Setting 202
Authorization Configuration 118
Configuration ID 119
Tracking Parameter 188
Reporting Parameter 190
Action Parameter 192
Authorization Schema 194
Monitoring Instructions 193
Authorized Ex.Instr. 195
Unauthorized Ex. Instr. 197
Executable Instructions 124
Signature 206
Device Type 117
API 208
Processing Engine 210
Processing Subsystems 212
Communications Module 214

Fig. 3

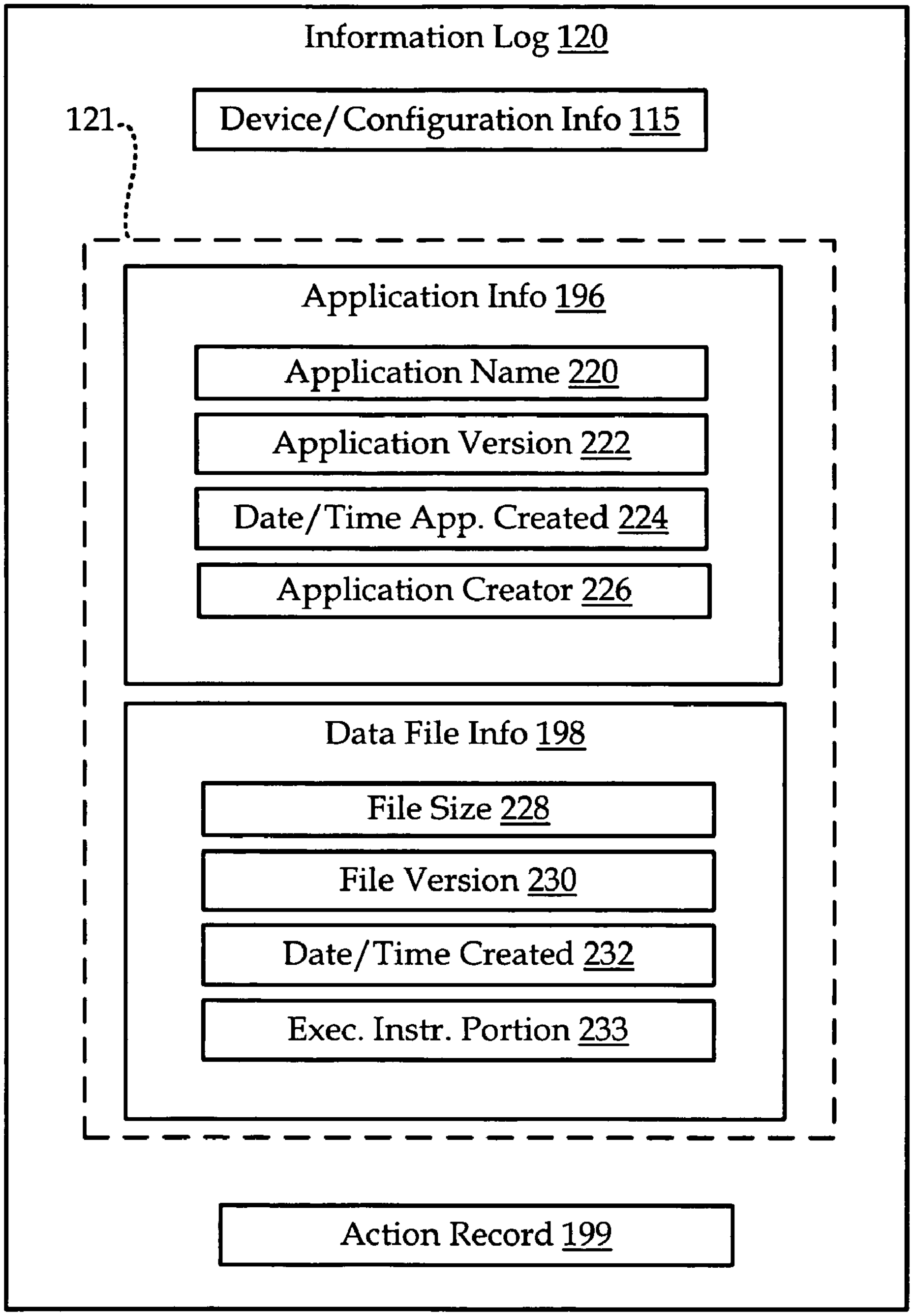

Information Log 120
121
Device/Configuration Info 115
Application Info 196
Application Name 220
Application Version 222
Date/Time App. Created 224
Application Creator 226
Data File Info 198
File Size 228
File Version 230
Date/Time Created 232
Exec. Instr. Portion 233
Action Record 199

Fig. 4

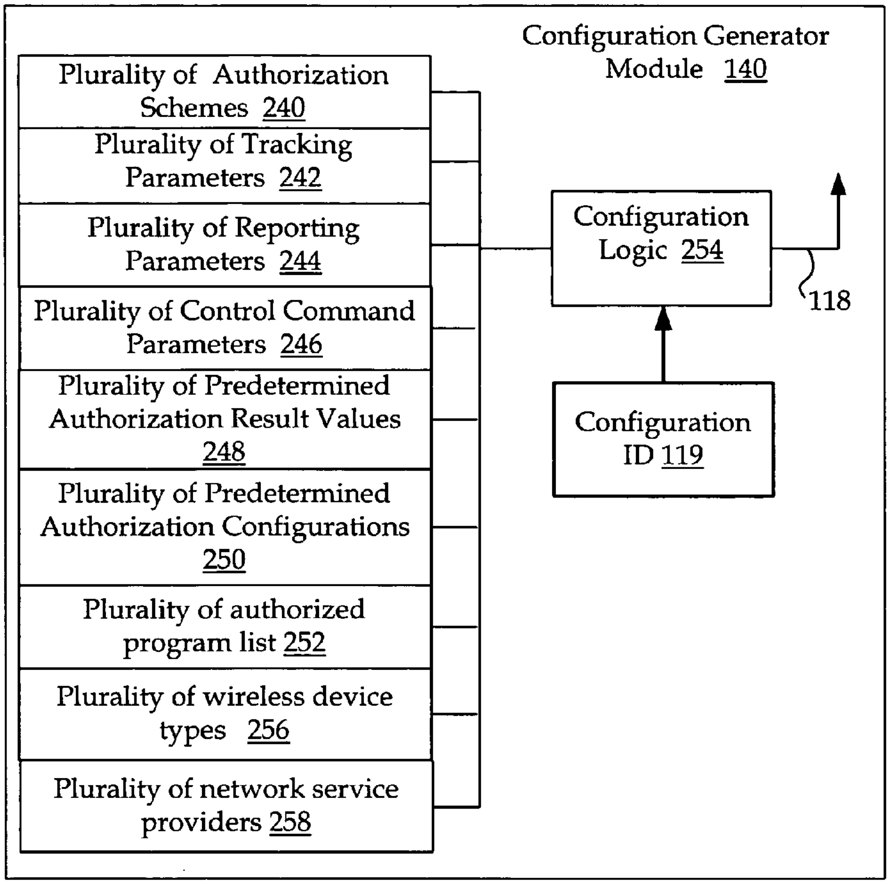

Configuration Generator Module 140
Plurality of Authorization Schemes 240
Plurality of Tracking Parameters 242
Plurality of Reporting Parameters 244
Plurality of Control Command Parameters 246
Plurality of Predetermined Authorization Result Values 248
Plurality of Predetermined Authorization Configurations 250
Plurality of authorized program list 252
Plurality of wireless device types 256
Plurality of network service providers 258
Configuration Logic 254
118
Configuration ID 119

Fig. 5

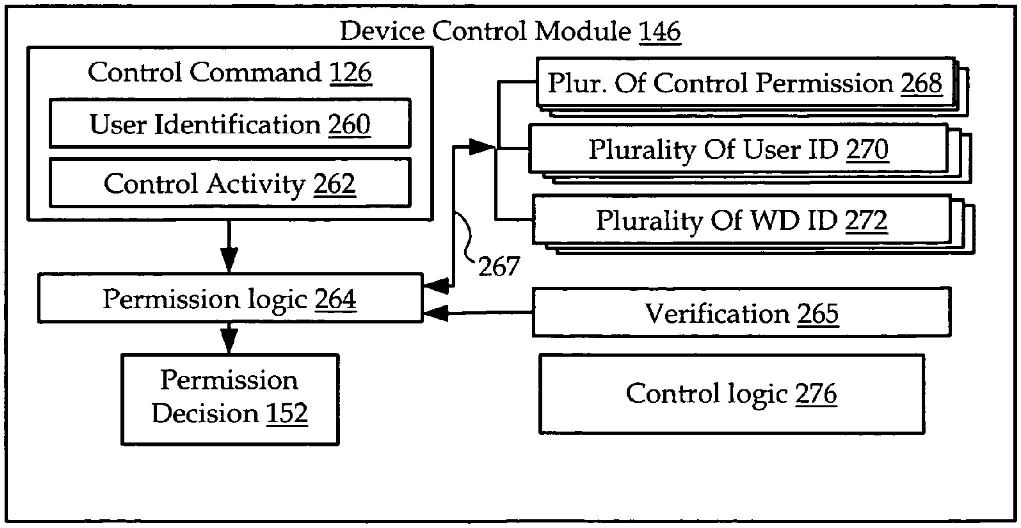
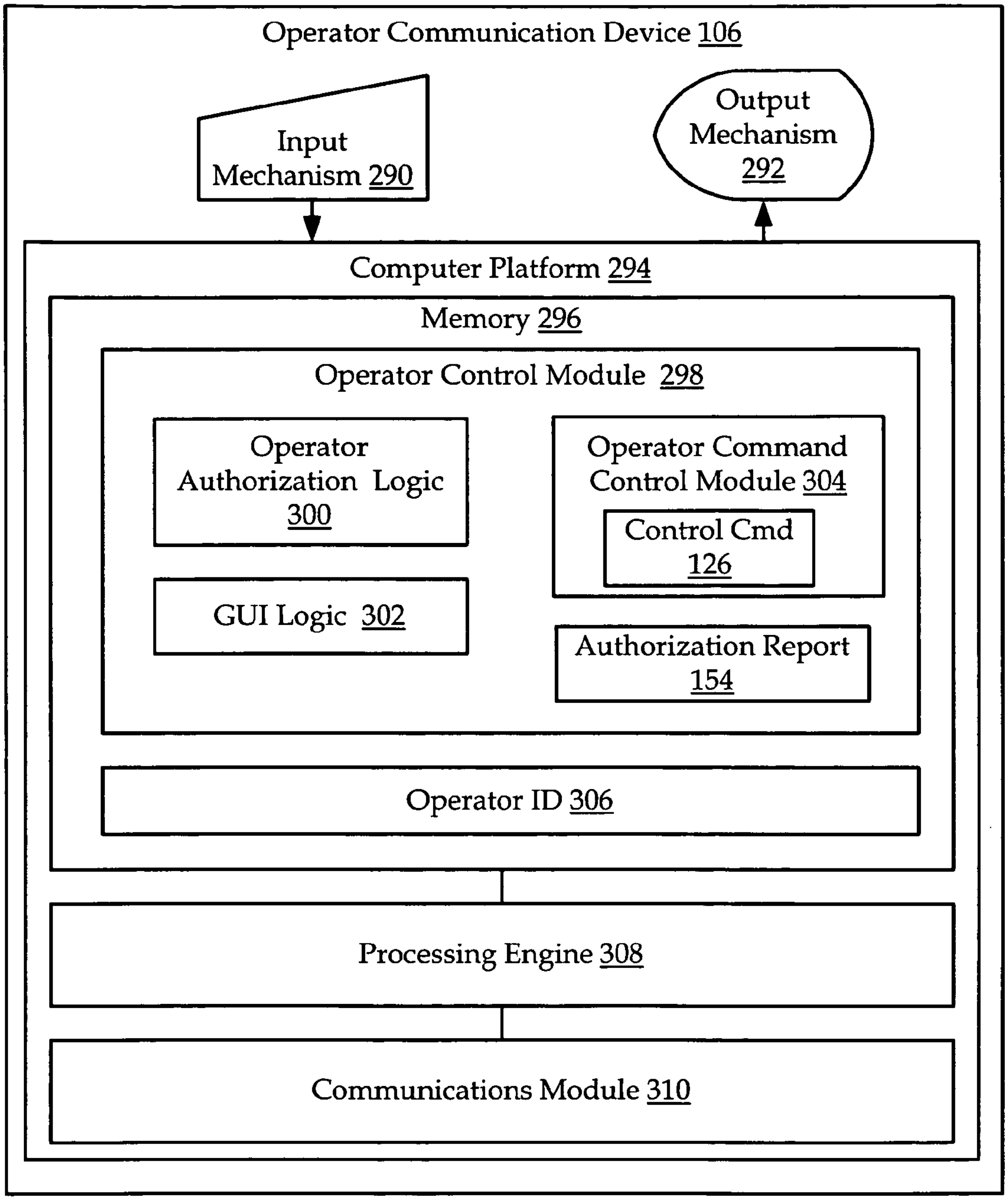

Device Control Module 146
Control Command 126
User Identification 260
Control Activity 262
Plur. Of Control Permission 268
Plurality Of User ID 270
Plurality Of WD ID 272
267
Permission logic 264
Verification 265
Permission Decision 152
Control logic 276

Fig. 6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Input Mechanism 290
Output Mechanism 292
Computer Platform 294
Memory 296
Operator Control Module 298
Operator Authorization Logic 300
Operator Command Control Module 304
Control Cmd 126
GUI Logic 302
Authorization Report 154
Operator ID 306
Processing Engine 308
Communications Module 310

Fig. 7

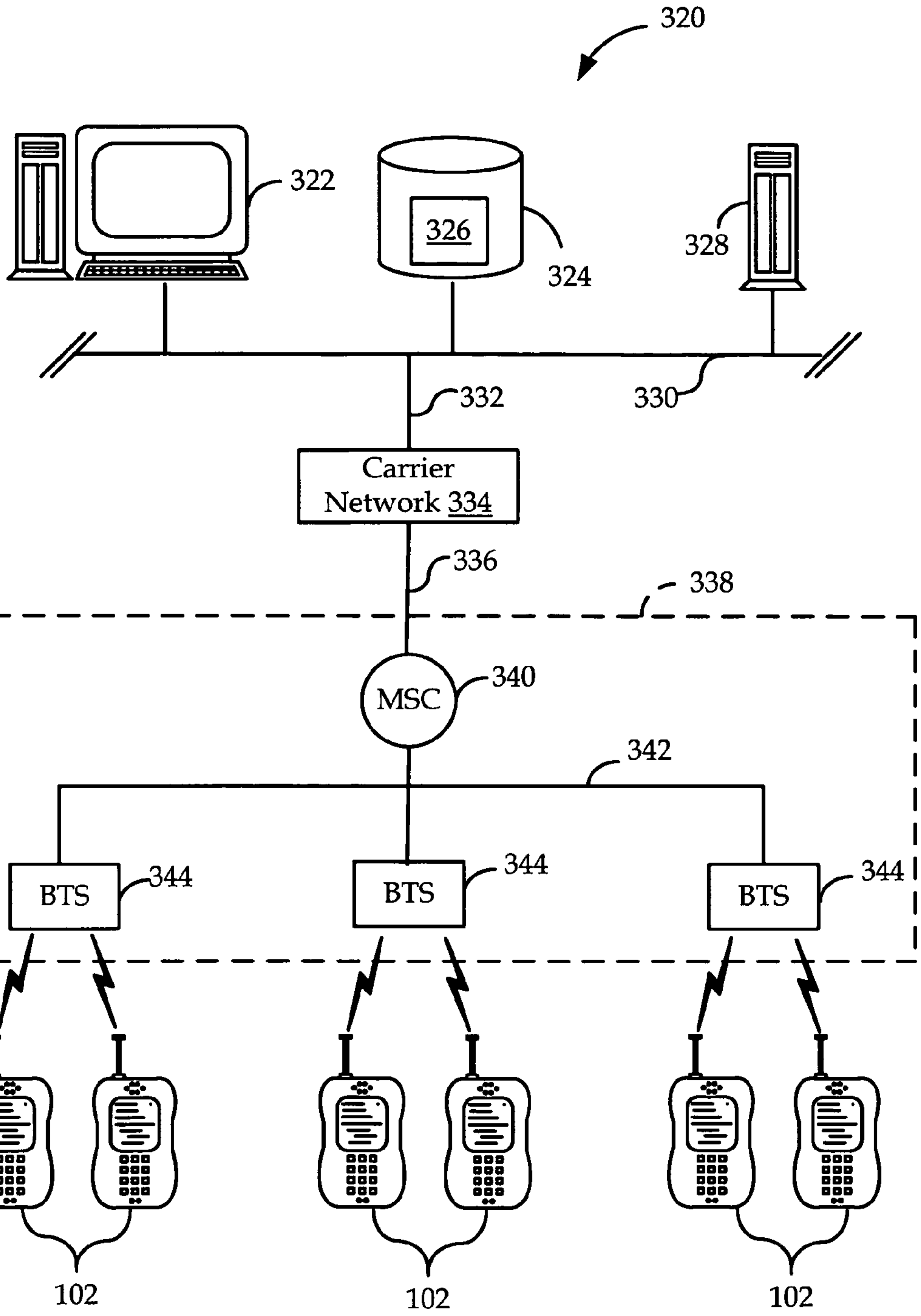
320
322
326
324
328
332
330
Carrier Network 334
336
338
MSC
340
342
BTS
344
BTS
344
BTS
344
102
102
102

Fig. 8

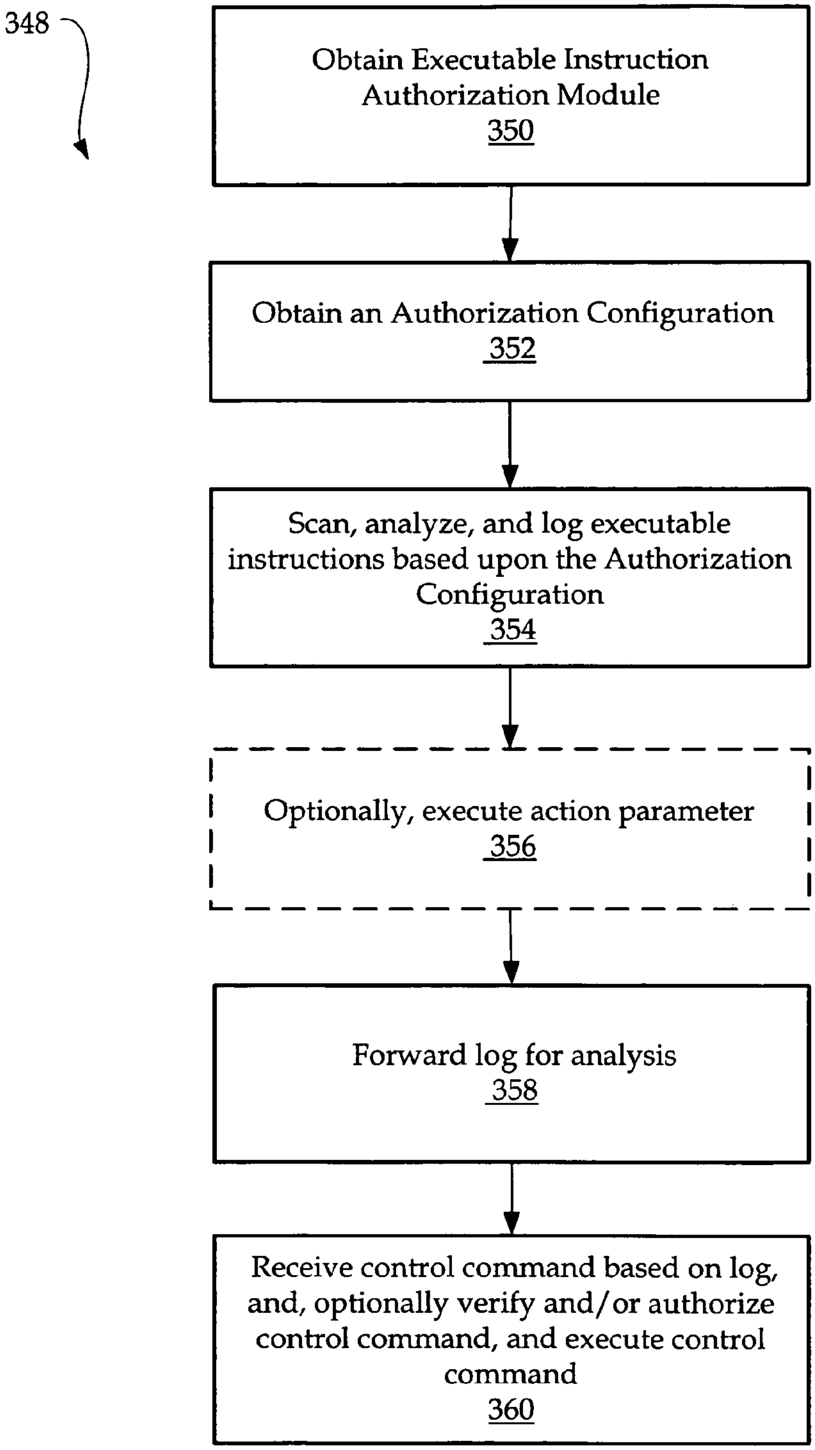
348
Obtain Executable Instruction Authorization Module 350
Obtain an Authorization Configuration 352
Scan, analyze, and log executable instructions based upon the Authorization Configuration 354
Optionally, execute action parameter 356
Forward log for analysis 358
Receive control command based on log, and, optionally verify and/or authorize control command, and execute control command 360

Fig. 9

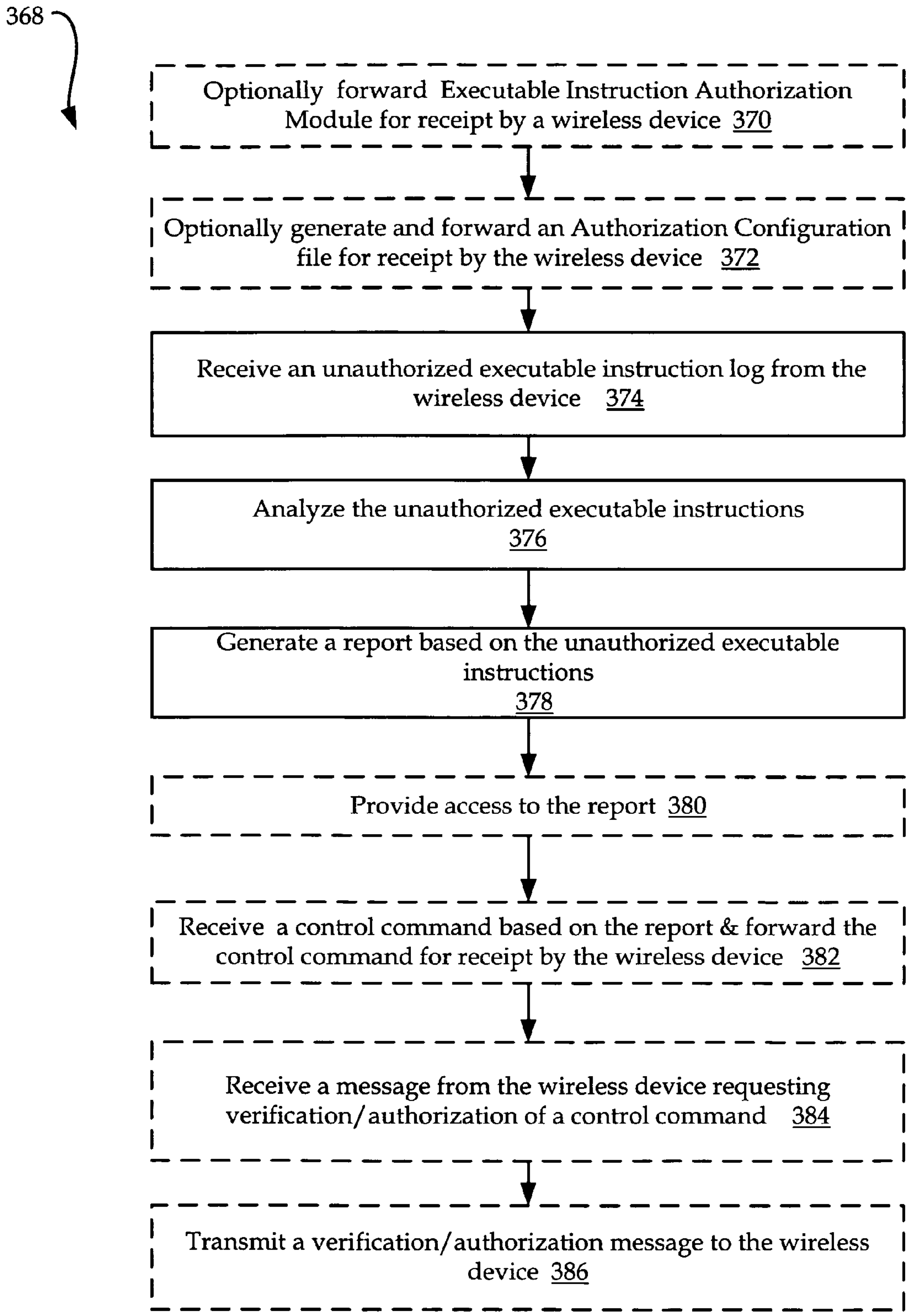
368
Optionally forward Executable Instruction Authorization Module for receipt by a wireless device 370
Optionally generate and forward an Authorization Configuration file for receipt by the wireless device 372
Receive an unauthorized executable instruction log from the wireless device 374
Analyze the unauthorized executable instructions 376
Generate a report based on the unauthorized executable instructions 378
Provide access to the report 380
Receive a control command based on the report & forward the control command for receipt by the wireless device 382
Receive a message from the wireless device requesting verification/authorization of a control command 384
Transmit a verification/authorization message to the wireless device 386

Fig. 10

APPARATUS AND METHODS FOR DETECTION AND MANAGEMENT OF UNAUTHORIZED EXECUTABLE INSTRUCTIONS ON A WIRELESS DEVICE

CLAIM OF PRIORITY UNDER 35 U.S.C. §119

The present Application for Patent claims priority to Provisional Application No. 60/690,222 entitled "Methods and Apparatus for Scanning Virus in a Wireless Device,"filed Jun. 13, 2005, assigned to the assignee hereof and hereby expressly incorporated by reference herein.

BACKGROUND

The described embodiments generally relate to wireless communication devices and computer networks. More particularly, the described embodiments relate to the detection and disposition of unauthorized executable instructions on a wireless device.

Wireless networking connects one or more wireless devices to other computer devices without a direct electrical connection, such as a copper wire or optical cable. Wireless devices communicate data, typically in the form of packets, across a wireless or partially wireless computer network and open a "data" or "communication" channel on the network such that the device can send and receive data packets. The wireless devices often have wireless device resources, such as programs and hardware components, which individually and cooperatively operate to use and generate data in accordance to their design and specific protocol or configuration, such as using open communication connections to transmit and receive data on the network.

Wireless devices are being manufactured with increased computing capabilities and are becoming tantamount to personal computers. These "smart" wireless devices, such as cellular telephones, have application programming interfaces ("APIs") installed onto their local computer platform that allow software developers to create software applications that operate on the cellular telephone. The API sits between the wireless device system software and the software application, making the cellular telephone functionality available to the application without requiring the software developer to have the specific cellular telephone system source code.

In one aspect, the integrity of the wireless device may be compromised by either the intended or non-intended downloading of certain executable instructions. In one scenario, such downloads may include a malicious program targeting cellular telephones, for example, spread through Bluetooth® wireless systems. Such executable instructions may be a worm program whose task could be as simple as stealing the cellular telephone's address book or generating costly and annoying text message spam. Another potential threat to the integrity of a wireless device may take the form of a "denial of service" attack on a wireless-service provider by making the cellular telephone dial many numbers in rapid succession. In another example, malicious applications may affect the operation of the wireless device, allowing the wireless device to be used for a different wireless network service provider than the one for which it was purchased. In this case, the original wireless network service provider may lose money if it subsidized the price of the wireless device based on the agreement that the wireless device would only be used on the original network service provider's network.

Furthermore, an initial scan of a downloaded application may not prove sufficient to detect possible malicious intent. It may be necessary to monitor the operation of the program to determine whether or not an application first thought to be authorized has either been modified or has indeed performed some unauthorized act, i.e., accessed a protected memory location.

In addition to the possible loss of device integrity due to either malicious or unintentional downloading of unauthorized executable instructions, a cellular carrier network may lose revenue by uncompensated downloading of otherwise non-malicious executables. For example, in many cases when a new mobile device is introduced to the market and is well received by the public, a host of software companies will attempt to cash in on the popularity of the product by offering third party applications. These executables, when made available to the user via sources other than the cellular manufacturer or carrier, not only may adversely affect the operation of the wireless device but may also result in millions of dollars in lost revenue.

Accordingly, it would be advantageous to provide an apparatus and method that allows for scanning a wireless device for executable instructions, monitoring its operation, and may include the deleting and otherwise disabling of such instructions based upon an authorization schema.

SUMMARY

The described embodiments comprise apparatus, methods, computer readable media and processors operable for managing executable instructions on a wireless device based upon a flexible authorization configuration and control commands supplied by at least one of a network service provider, wireless device manufacturer and other authorizing parties. The authorization configuration may initiate the detection, deletion, disablement or otherwise management actions of malicious files or other unauthorized executable instructions so that the quality of service of the respective wireless device is maintained, revenue is generated, and lost revenue is minimized.

Virus scanning methods and apparatus for wireless devices may include an authorization module operable on a wireless device to apply an authorization schema to executable instructions on the wireless device. The executable instructions may not be limited to executable file types. For instance, executable instructions may be found in any file type, for example, picture files, movie files, text files, and sound files, i.e. ring tones. The memory may be scanned according the authorization schema and a log of unauthorized instructions may be generated and forwarded to a user manager.

The user manager may be operable to analyze the log to determine whether the logged executable instructions may be authorized, or whether the logged executable instructions contain a virus or is otherwise unauthorized, as well as to determine any action to be taken in regard to the executable instructions identified as unauthorized executable instructions.

In addition, the user manager may be operable to generate an authorization report which may be viewable by an operator. If not approved by the operator, the unauthorized executable may be treated as being undesirable, such as a virus, and may be deleted or otherwise disabled.

Additionally, the network service provider may need to be able to disable an executable on a wireless device when the executable for that specific wireless device has become obsolete, or when the wireless device is being used on a different service provider's network in violation of an agreement.

In one aspect, a wireless device comprises a memory comprising executable instructions, a device type corresponding to wireless device, and an authorization configuration having an authorization schema that identifies at least one of authorized and unauthorized executable executable instructions, wherein the authorization schema is based upon a device type associated with the wireless device. The wireless device additionally comprises an authorization module resident in the memory. The authorization module comprises authorization logic operable to scan executable instructions and generate a log based upon the authorization configuration. The log comprises an identification of the executable instructions determined to be unauthorized based upon the authorization schema.

Another aspect of a wireless device may comprise means for obtaining an authorization configuration comprising an authorization schema that identifies at least one of authorized executable instructions and unauthorized executable instructions, wherein the authorization schema is based upon a device type associated with the wireless device. This aspect of the wireless device may further comprise means for scanning executable instructions based upon the authorization configuration, and means for logging at least portions of the scanned executable instructions into a log based upon the authorization schema. Additionally, this aspect of the wireless device may further comprise means for forwarding the log to another device to determine a disposition of the logged executable instructions.

In another aspect, a method of managing executable instructions on a wireless device comprises obtaining an authorization configuration comprising an authorization schema that identifies at least one of authorized and unauthorized executable instructions, wherein the authorization schema is based upon a device type associated with the wireless device. This aspect of the method also comprises scanning executable instructions based upon the authorization configuration, and logging at least portions of the scanned executable instructions into a log based upon the authorization schema. Additionally, this aspect of the method further comprises forwarding the log to another device to determine a disposition of the logged executable instructions. In a related aspect, at least one processor is configured to perform the above-described actions. Another related aspect comprises a machine-readable medium comprising instructions which, when executed by a machine, cause the machine to perform operations comprising the actions noted above.

A further aspect comprises an apparatus for managing executable instructions on a wireless device comprises a configuration generator operable to generate and transmit an authorization configuration for receipt by a wireless device. The authorization configuration comprises an authorization schema that identifies at least one of authorized executable instructions and unauthorized executable instructions, wherein the authorization schema is based upon a device type associated with the wireless device. Further, the apparatus comprises an information repository operable to receive and store a log, the log comprising unauthorized executable instructions on the wireless device based on the authorization configuration. Additionally, the apparatus comprises an executable instruction control module comprising an analyzer operable to generate an authorization report based on the log.

A further aspect of an apparatus for managing executable instructions on a wireless device may comprise means for generating an authorization configuration executable to initiate scanning and logging of executable instructions resident on a wireless device. The authorization configuration comprises an authorization schema that identifies at least one of authorized executable instructions and unauthorized executable instructions, wherein the authorization schema is based upon a device type associated with the wireless device. This aspect further comprises means for forwarding the authorization configuration for receipt by the wireless device, and means for receiving a generated log from the wireless device based on the authorization configuration. Additionally, this aspect comprises means for generating an authorization report based on the received log.

An aspect of a method of executable instruction management on a wireless device comprises generating an authorization configuration executable to initiate scanning and logging of executable instructions resident on a wireless device. The authorization configuration comprises an authorization schema that identifies at least one of authorized executable instructions and unauthorized executable instructions, wherein the authorization schema is based upon a device type associated with the wireless device. This aspect further comprises forwarding the authorization configuration for receipt by the wireless device, and receiving a generated log from the wireless device based on the authorization configuration. Additionally, this aspect comprises generating an authorization report based on the received log. In a related aspect, at least one processor is configured to perform the above-described actions. Another related aspect comprises a machine-readable medium comprising instructions which, when executed by a machine, cause the machine to perform operations comprising the actions noted above.

BRIEF DESCRIPTION OF THE DRAWINGS

The disclosed embodiments will hereinafter be described in conjunction with the appended drawings provided to illustrate and not to limit the disclosed embodiments, wherein like designations denote like elements, and in which:

FIG. **1** is a schematic diagram of one aspect of a system for managing executable instructions on a wireless device based upon an executable instructions authorization configuration;

FIG. **2** is a message flow diagram associated with the system of FIG. **1**;

FIG. **3** is one aspect of an architecture diagram of the wireless device of FIG. **1**;

FIG. **4** is a schematic diagram of one aspect of a log associated with the wireless device of FIG. **1**;

FIG. **5** is a schematic diagram of one aspect of an configuration generator module associated with the user manager of FIG. **1**;

FIG. **6** is a schematic diagram of one aspect of a device control module associated with the user manager of FIG. **1**;

FIG. **7** is one aspect of an architecture diagram of the operator device of FIG. **1**;

FIG. **8** is a schematic diagram of one aspect of a cellular telephone network aspect of FIG. **1**;

FIG. **9** is a flowchart of one aspect of a method operable on a wireless device for performing executable instruction authorization according to the system of FIG. **1**; and

FIG. **10** is a flowchart of one aspect of a method operable on a unit manager for analyzing and providing executable instruction authorization according to the system of FIG. **1**.

DETAILED DESCRIPTION

FIG. **1** illustrates one aspect of a system **100** comprising apparatus and methods of managing executable instructions on a wireless device based upon an authorization configuration. The term “executable instructions,” as used herein, refers to software applications and/or a piece of code that may be stored in the wireless device as a standalone program and/or file, and/or that may be imbedded within files containing predominantly non-executable data, such as picture files, movie files, text files, and sound files. These executable instructions may be received by and/or stored on and/or executed by a wireless device. System **100** is operable to monitor and analyze all executable instructions received by and/or resident on a wireless device to detect unauthorized executable instructions, which may be referred to as a "virus," and to determine a disposition of such instructions. Unauthorized executable instructions, or viruses, may be any unapproved instructions, which may include instructions having malicious effects on the operations of the wireless device, and which may further include other instructions having non-malicious effects on the wireless device, as will be discussed below in more detail.

Generally, system **100** may include a wireless device **102** in communication with a user manager server **104**, which provides device control functionality, via a wireless network **110**. Further, user manager **104** may be in communication with an operator workstation **106**, which provides access to the functionality of user manager server **104**, such as via a wired or wireless connection. In one scenario, wireless device **102** receives authorization configuration **118**, which may be provided by executable instruction control module **130** of user manager **104**, to detect executable instructions **124** received by and/or resident on the wireless device, and to determine whether or not the instructions are unauthorized and thus may be considered a "virus." Log **120** on wireless device **102** stores unauthorized executable instruction information **121**, which comprises at least some relevant portion of any detected virus and/or unauthorized executable instructions, and as may be dictated by authorization configuration **118**. User manager **104** receives log **120** from wireless device **102**, and analyzer **142** processes the log and generates an authorization report **154** providing details relating to the executable instructions detailed by the unauthorized instruction information **121**. The authorization report **154** may be reviewed, such as by operator **108** at workstation **106**, and a control command **126** may be generated to provide a disposition of the unauthorized executable instructions **121**, such as to delete a virus or allow a non-virus, and/or to update authorization configuration **118**, such as to update the identification of authorized and/or unauthorized executable instructions, based on the information contained in authorization report **154**.

FIGS. **1** and **3** disclose an aspect of the wireless device **102**, which may comprise a computer platform **112** that includes a executable instruction authorization module **114**. Executable instruction authorization module **114** may be downloaded to the wireless device **102** via at least one of several mechanisms including, but not limited to, wireless transmission over a wireless network, a wired connection to a personal computer (PC), and loaded at the time of manufacture of the wireless device or the associated computer platform. The executable instruction authorization module **114** further comprises various software components, including but not limited to, authorization logic **116**, authorization configuration **118**, a log **120**, and a wireless device control module **122**. Wireless device control module **122** may further include control command **126** operable to delete, disable, or otherwise render inoperative any executable instructions **124** determined to be unauthorized, i.e. a "virus," by the definition described herein.

FIG. **2** illustrates an aspect of a sequence of messages transmitted between the operator communication device **106**, such as a computer workstation, the user manager server **104**, and a wireless device **102**. At step **160**, an executable instruction control module **130** resident on user manager **104** may generate an initial authorization configuration **118** that may be transmitted, at step **162**, to the wireless device **104**. Alternatively, the user manager **104** may generate and transmit at least portions of an updated authorization configuration **118** to replace or update an existing configuration **118**.

At step **164**, authorization logic **116**, which may run as a background process in the wireless device **102**, is operable to parse the received configuration file **118** to derive configuration parameters, including but not limited to tracking parameter **188**, reporting parameter **190**, action parameter **192**, and authorization schema **194**. Based upon tracking parameter **188**, the authorization logic **116** may scan executable instructions upon being downloaded onto device **102**, or may scan all memory resident executable instructions on the wireless device **102**.

Scanning for unauthorized executable instructions may be implemented using at least one of several mechanisms stored in the authorization schema **194**. Based upon authorization schema **194**, specific elements of instructions determined to be unauthorized may be stored in log **120** as unauthorized executable instruction information **121**. Alternatively, or in addition, wireless device **102** may include logic that allows for automatic deletion or disablement of unauthorized executable instructions upon detection of the unauthorized executable instructions, as is discussed below in more detail.

At step **166** log **120** may be uploaded from wireless device **102** across a wireless network **110** to the user manager **104**. Executable instruction control module **130** may be operable to store log **120** in an information repository **136**.

At step **168**, executable instruction control module **130** may access log **120** and execute an analyzer **142** operable to process the log **120**, analyze the collected data, and generate an authorization report **154**. Analyzer **142** is discussed in detail further below.

At step **170**, executable instruction control module **130** may transmit authorization report **154**, across the wireless network **110** in one aspect, to operator workstation **106** for review. In one aspect, the operator **108** may review the authorization report **154** at step **172** and transmit, at step **174**, a control command **126** to the user manager **104**, and control manager **130** may validate the command **126** at step **176** before relaying the command to the wireless device **102** at step **178**. The command **126** may be operable, at step **180**, to execute activities on the wireless device **102**, including, but not limited to, deleting and disabling unauthorized executable instructions, restoring previously disabled executable instructions, and/or updating an authorization status of a given executable instruction, such as by adding the executable instruction to an authorized executable instructions list or removing the executable instruction from an unauthorized executable instruction list.

It should be noted that, in some alternate aspects, the above sequence of events may be initiated, at step **182**, by wireless device **102** or a device user directly contacting operator communications device **106** or the associated operator **108** to report suspicion of a virus. In this scenario, at step **184**, operator communications device **106** or the associated operator **108** sends a message to user manager **104** to direct the downloading of executable instruction module **114** and/or authorization configuration **118** to the respective wireless device **102**.

Thus, the present apparatus, methods, computer-readable media and processors operate to provide executable instruction management on a wireless device **102** based upon a modifiable authorization configuration **118**.

Referring to FIG. **3**, wireless device **102** can include any type of computerized, wireless device, such as cellular telephone **102**, personal digital assistant, two-way text pager, portable computer, and even a separate computer platform that has a wireless communications portal, and which also may have a wired connection to a network or the Internet. The wireless device can be a remote-slave, or other device that does not have an end-user thereof but simply communicates data across the wireless network **110**, such as remote sensors, diagnostic tools, and data relays.

Apparatus and methods of executable instruction authorization on the wireless device may include scanning, collecting, reporting, deleting, disabling, and restoring activities. Furthermore, the apparatus and methods may include tracking/monitoring the usage of wireless device resources to determine if the operation of any executable instruction **124** comprise unauthorized acts, as defined by authorization configuration **118**. Such unauthorized activities may include, but are not limited to, attempting to read/write from/to a predetermined memory location, reading/writing from/to a predetermined memory location, deleting another program/data, and attempting to and/or accessing to predetermined resources, such as an attempt to transmit data via the communications module **214**. The tracking/monitoring parameters are user configurable and may be downloaded from a user manager.

Activities performed by the herein described apparatus and methods may be performed on any form of wireless device or computer module, including a wired or wireless communication portal, including without limitation, wireless modems, PCMCIA cards, access terminals, personal computers, telephones, or any combination or sub-combination thereof.

Wireless device **102** may also include input mechanism **182** for generating inputs into wireless device **102**, and output mechanism **184** for relaying information to the user of the wireless device. For example, input mechanism **182** may include a mechanism such as a key or keyboard, a mouse, a touch-screen display, and a voice recognition module, while output mechanism **184** may include, but is not limited to, a display, an audio speaker, and a haptic feedback mechanism.

Computer platform **112** may be operable to: transmit data across wireless network **110**; receive and execute software applications; and to display data transmitted from user manager **104**, or another computer device connected to wireless network **110**. Computer platform **112** may also include a memory **186**, which may comprise volatile and nonvolatile memory such as read-only and/or random-access memory (RAM and ROM), EPROM, EEPROM, flash cards, or any memory common to computer platforms. Further, memory **186** may include one or more flash memory cells, or may be any secondary or tertiary storage device, such as magnetic media, optical media, tape, or soft or hard disk. Additionally, memory **186** may store executable instructions **124**, as well as device type information **117**, such as one or more of a make, model, manufacturer, version, etc. of the type of wireless device **102**.

Further, computer platform **112** may include a processing engine **210**, which may be an application-specific integrated circuit ("ASIC"), or other chipset, processor, logic circuit, or other data processing device. Processing engine **210** is operable to execute an application programming interface ("API") layer **208** that may interface with any resident programs, such as executable instruction authorization module **114**, stored in memory **186** of the wireless device **102**. In one aspect, API **208** is a runtime environment executing on the respective wireless device. One such runtime environment is Binary Runtime Environment for Wireless® (BREW®) software developed by Qualcomm, Inc., of San Diego, Calif. Other runtime environments may be utilized that, for example, operate to control the execution of applications on wireless computing devices.

Processing engine **210** includes various processing subsystems **212** embodied in hardware, software, firmware, executable instructions, data, and combinations thereof, that enable the functionality of wireless device **102** and the operability of the wireless device on wireless network **110**. For example, processing subsystems **212** allow for initiating and maintaining communications, and exchanging data, with other networked devices. In one aspect, such as in a cellular telephone, processing engine **210** may include one or a combination of processing subsystems **212**, such as: sound, nonvolatile memory, file system, transmit, receive, searcher, layer **1**, layer **2**, layer **3**, main control, remote procedure, handset, power management, diagnostic, digital signal processor, vocoder, messaging, call manager, Bluetooth® system, Bluetooth® LPOS, position determination, position engine, user interface, sleep, limited services, security, authentication, USIM/SIM, voice services, graphics, USB, multimedia such as MPEG, GPRS, etc. For the disclosed aspects, processing subsystems **212** may include any subsystem components that interact with applications executing on computer platform **112**. For example, processing subsystems **212** may include any subsystem components that receive data reads and data writes from API **208** on behalf of the resident executable instruction authorization module **114**. Further, at least a portion of information relating to executable instruction, gathered and logged in log **120**, may be available from these subsystems **212**.

Computer platform **112** may further include a communications module **214** embodied in hardware, software, executable instructions, data, and combinations thereof, operable to enable communications among the various components of the wireless device **102** and wireless network **110**. Communications module **152** may comprise any component/port/interface that may include any point of entry into, and/or any point of exit from wireless device. As such, communications module **152** may include interface components for hardwired communications and for wireless communications.

Computer platform **112** further includes executable instruction authorization module **114**, which is operable based on authorization configuration file **118** and may be loaded into memory **186** by various mechanisms including, but not limited to: being generated by any computer device connected to wireless network **110**, such as user manager **104**; locally transmitted to the wireless device **102** such as by a manual input from a user using input mechanism **182** and/or through transmission from a locally-connected media reader; and, having been loaded on the wireless device **102** at the time of manufacture. Further, executable instruction authorization module **114** may comprise an authorization module identification (ID) **113**, such as one or more of a name, a version, etc., that identifies the particular configuration of the given authorization module.

As disclosed above, authorization logic **116** of executable instruction authorization module **114** may be operable to collect, store, and provide access to, or forward to other devices, selected information relating to executable instructions **124** based on authorization configuration **118**. Furthermore, executable instruction authorization module **114** may be loaded onto the wireless device **102** during the initial assembly process, downloaded from a device on wireless network **110**, or loaded via direct connections during a configuration process.

As disclosed, authorization schema **194** may comprise an identification of authorized executable instructions **195** and/

or unauthorized executable instructions **197**. For example, authorized executable instructions **195** and/or unauthorized executable instructions **197** may include some reference or identification of at least a portion of executable instructions that have been deemed authorized and/or unauthorized, respectively, such as by a party having control over memory **186** of wireless device **102**, such as a network service provider. In one aspect, for example, authorization schema **194** may include a signature **206** comprising data relating to executable instructions **124**, including but not limited to at least one of application/file name, version, size, date/time created and creator, if any. For example, authorized executable instructions **195** may include a set of applications, files and/or data having embedded executable instructions, all of which are authorized for use on wireless device **102**, such as operating system software, application-specific software, and macro imbedded data files. In contrast, unauthorized executable instructions **197**, which may be referred to as a "virus," may include a set of applications, instruction imbedded files and/or data having embedded executable instruction, all of which are not authorized for use on wireless device **102**, such as known viruses and known incompatible application-specific software. It should be noted, however, that applications defined as a "virus" on one network, or on a particular wireless device **102**, may be considered authorized or approved by another set of network carrier and/or wireless device. For instance, an application may require a certain amount of memory and certain hardware components, such as a camera, a large screen, a global positioning system ("GPS") receiver, which may not be available on a user's device. Such a program may be authorized on one wireless device having the system requirements, but may be defined as a "virus" on a non-compliant device to avoid wasting limited resources.

In another aspect, authorization schema **194** may include, but is not limited to, instructions relating to predetermined authorization tests and predetermined authorization test results. For example, these tests and results include: a redundancy check, including a checksum, parity bits, check digits, longitudinal redundancy check, cyclic redundancy check ("CRC"), horizontal redundancy check, vertical redundancy check, cryptographic message digest, Fletcher's checksum, and Adler-32; testing for a predetermined value at a predetermined location within executable instructions **124**, where any attempt to conceal malicious or otherwise unauthorized executable instructions would be discovered by a check on the predetermined location; and testing for a predetermined result of applying a predetermined function to all or a portion of the data and/or the code contained within executable instructions **124**. Data extracted from the scanned file, and/or authorization test results obtained from applying the above predetermined authorization tests may then compared to predetermined values and/or predetermined results, respectively, stored remotely, such as in executable instruction control module **130**, or locally such as in the authorization schema **194**, to determine whether or not the given executable instructions are authorized.

In another aspect, authorization schema **194** may include monitoring instructions **193** relating to monitoring the operations of executable instructions **124**, such as monitoring predetermined wireless device resources, including memory and peripherals, attempting to be or being utilized by the executable instructions. For example, the authorization schema **194** may monitor the resource utilization of all operating applications, with configurable parameters indicating memory locations, processing subsystems, memory utilization, and allowable or unallowable activities, such as overwriting applications and reading and writing to predetermined areas of memory.

As disclosed relative to the discussion of FIG. **2**, the authorization configuration comprises parameters used by the authorization logic **116** to perform the operations disclosed herein.

Tracking parameter **188** may be operative to determine when to scan the memory **124**. For example, tracking parameter **188** may instruct logic **116** to scan memory **186** periodically, when new executable instructions are downloaded, when executable instructions are in operation, and when existing information is deleted.

In addition, tracking parameter **188** may determine where to store log **120**, for example, in memory **186**, or another memory device connectable to the wireless device or accessible to the wireless device **102** over the wireless network **110**. In addition, tracking parameter **188** may determine whether the entire memory **186** is scanned or just predetermined portions of the memory, such as executable instructions that are active, that are currently being downloaded, and/or that were downloaded within a past user/system configured period.

Furthermore, tracking parameter **188** may control which portions of executable instruction **124** is deemed to be a "virus" and is therefore logged as unauthorized executable instruction information **121**.

Referring to FIG. **4**, for example, information log **120** may comprise a record of unauthorized executable instruction information **121** which may include, but is not limited to: application information **196** such as the application name **220**, application version **222**, date and time created **224**, and the creator **226** of the application; and data file information **198**, such as relating to data files that may contain executable instructions, may include file size **228**, file version **230**, and date/time created **232**, and at least some executable instruction portion **233**. Further, information log **120** may include action record **199** of actions taken by authorization module **114**, as is discussed below in more detail. Finally, information log **120** may include device/configuration information **115**, such as one or a combination of authorization module ID **113** and/or configuration ID **119**, and wireless device information such as hardware and software information, for example, information identifying the model of the device, the resident hardware, the resident software, the state of selected hardware and/or software components, etc. and generally any information that may be useful in troubleshooting or determining a diagnostic status of wireless device **102**.

In addition, tracking parameter **188** may control the monitoring of running applications, e.g. the actions being requested and/or performed by any executable instructions. Non-limiting, application monitoring may be configured, for example, to occur periodically on a predetermined schedule, within a predefined period after initial loading, based on a predetermined event such as running an application, and on an ongoing basis.

Reporting parameter **190** may configure executable instruction authorization module **114** to selectively transmit log **120** to executable instruction control module **130** across wireless network **110**. The timing of log transmission is non-limiting and may be transmitted at a predetermined time, a predetermined interval, and on the occurrence of predetermined events, such as upon downloading of executable instructions, establishing a communication channel with communications network **110** and upon determination of a virus or suspect executable instructions. Further, reporting parameter **190** may determine whom to allow local access to log **120**, thereby allowing a remote device such as the user manager **104** to access memory **186** and retrieve log **120** directly.

In one aspect, log **120** is transmitted over an open communication connection between the wireless device **102** and the wireless network **110**, "piggybacking" on an ongoing voice or data call across an open connection. Alternatively, in a cellular network configuration, the log **120** may be transmitted to executable instruction control module **130** through short message service ("SMS"). Furthermore, as noted above, an alternate aspect of the user manager module may "pull" the log **120** from the wireless device **102** across the network **110** on a scheduled or ad hoc basis.

Action parameter **192** may instruct logic **116** on how and when to disable, delete, restore or otherwise act upon executable instructions identified as unauthorized. For example, deleting executable instructions may be accomplished by physically deleting the executable instructions from memory **194**, while disabling executable instructions may be accomplished by altering some portion of executable instructions **124** to prevent its operation on wireless device **102**. Although deleted executable instructions may or may not be restored, one aspect of system **100** may allow disabled executable instructions to be recovered by an appropriate setting of action parameter **192**, and/or by an appropriate control command **126** transmitted from the user manager **104** or operator **108**.

Action parameter **192** may be operable to instruct logic **116** to act upon unauthorized executable instructions without further communications/commands from a remote source. For example, in one aspect where authorization schema **194** has locally determined that downloaded executable instructions **124** is either not identifiable as authorized executable instruction **195** or is identifiable as unauthorized executable instruction **197**, i.e. an instruction that contains a virus or is otherwise unauthorized, action parameter **192** may identify a corresponding action to take by the executable instruction authorization module **114**. In this scenario, for example, based on action parameter **192**, authorization module **114** may delete or disable the given executable instruction **124**, and the action taken may be logged as an action record **199** in log **120**.

Additionally, authorization configuration **118** may include a configuration identification (ID) **119**, such as one or more of a name, a version, etc., which identifies the given set of parameters associated with the given configuration.

Executable instruction authorization module **114** further includes wireless device control module **122**, which under control of authorization logic **116** is operable to execute on the wireless device **102** a locally or remotely generated control command **126**. Wireless device control module **122** may have the same components and/or functionality as a user manager device control module **146** (FIG. **1**), and, as will be explained in more detail below, the wireless device control module **122** may request verification and/or authorization of a control command **126** before its execution.

For example, control command **126** may be any executable operation on wireless device **102** related to handling executable instructions **124** identified as unauthorized executable instructions. For example, control command **126** may include, but is not limited to, the operations of deleting, disabling, and/or restoring executable instructions. Control command **126** may comprise actions similar to those discussed above with regard to action parameter **192**, which essentially may be a predetermined or preprogrammed control command **126**. In general, the control command **126** is issued based upon a review of executable instructions **124** identified by executable instruction authorization module **114** as being unauthorized, which may be executable instructions directly identifiable as unauthorized executable instructions **197** and/or which may be executable instructions that are not identifiable as authorized executable instructions **195**. Based upon an inspection, such as by operator **108**, of the information relating to executable instructions **124** reported in log **120**, a determination of the status of the logged executable instructions may be made, and control command **126** issued to delete, disable or restore the executable instructions on the wireless device **102**. It should be noted that other control commands **126** may be utilized depending on the given scenario.

Further, executable instruction authorization module **114** may include a limited service configuration **200** operable to establish a limited-access communications channel across the wireless network **110**, which, in one aspect, is generally not available to the end user of wireless device **102**. For example, the limited-access communications channel may be used for transmitting log **120** or for receiving control command **126**. Further, in the case when communications from wireless device **102** have otherwise been disabled, the limited-access communications channel may allow emergency calls to an operator **108** or other designated party. The identification and set-up of the limited-access communications channel is based on a limited service setting **202**. Limited service setting **202** may identify the type of communications that are allowed, and may identify the associated communication channels that can be utilized. Limited service configuration **200** may be received over the wireless network **110**, may be locally transferred to wireless device **102**, such as through a serial connection, or may be preloaded on the wireless device **102**.

Referring back to FIG. **1**, user manager **104** may comprise at least one of any type of server, personal computer, mini computer, mainframe computer, or any computing device either special purpose or general computing device. Further, there can be separate servers or computer devices associated with user manager **104** that work in concert to provide data in usable formats to parties, and/or to provide a separate layer of control in the data flow between the wireless devices **102** and user manager **104**. User manager **104** (or plurality of servers) can send software agents or applications, such as the executable instruction authorization module **114**, to wireless device **102** across wireless network **110**, such that the wireless device **102** returns information from its resident applications and subsystems **212**.

User manager **104** comprises executable instruction control module **130** which may further include software, hardware, data, and generally any executable instructions operable to analyze and authorize executable instructions on wireless device **102**. Furthermore, executable instruction control module **130** may be operable to download all or a portion of executable instruction authorization module **114** to a wireless device **102**. Further, executable instruction control module **130** may include authorization logic **134** which is executable to generate authorization configuration **118** and manage the collection and analysis of log **120** from wireless device **102**. As previously disclosed, executable instruction control module **130** may "pull" the log **120** based on commands from an authorized user, such as operator **108**, or the log may be "pushed" from the wireless device **102**.

Referring to FIGS. **1** and **5**, an aspect of an executable instruction control module **130** may include configuration generator module **140** that includes hardware, software, firmware, executable instructions, data, and/or any other associated logic that allows the configuration generator module **140** to generate authorization configuration **118**. In one aspect, configuration generator module **140** may be operable to execute authorization logic **134** that assembles the various components of a given authorization configuration **118** based on selections from a number of parameters. For example, parameters that make up authorization configuration **118** may vary depending on the type/make/model of the wireless device and/or the network service provider. As such, configuration logic **254** may provide a user with the ability to select from a menu of a plurality of wireless device types/models **256** and a plurality of network service providers **258** in order to generate an appropriate menu from which to select the parameters of authorization configuration **118**.

Similarly, there may be one or more of each type of parameter comprising authorization configuration **118**. For example, configuration logic **254** may provide a user with the ability to select from a menu of at least one of a plurality of authorization schemas **240**, a plurality of tracking parameters **242**, a plurality of reporting parameters **244**, a plurality of control command parameters **246** and a plurality of predetermined authorization result values **248**. Alternatively, rather than selecting the various parameters individually, configuration logic **254** may provide the user with the ability to select from a menu of a plurality of predetermined authorization configurations **250**, which include predetermined groupings of the above-noted parameters that comprise authorization configuration **118**.

Further, in one aspect, the selected one of the plurality of wireless device types/models **256** and the selected one of the plurality of network service providers **258** may be correlated to a given one of a plurality of types of executable instructions **252**, such as application files and data files, and/or a predetermined set of authorization parameters that are appropriate for a particular wireless device **102**. For example, for an XYZ brand of wireless device operating on ABC wireless service provider, configuration logic **254** may be able to determine which executable instructions **124** the wireless device **102** should have installed, and thus may generate authorization configuration **118** that includes the appropriate set of corresponding parameters.

Once the specific parameters of a given configuration **118** are determined, then configuration logic **254** may assign unique configuration ID **119** to the given configuration, and may store this configuration in a library for later recall, such as among plurality of predetermined authorization configurations **250**. Further, configuration logic **254**, and/or another component of executable instruction control module **130**, may be operable to transmit authorization configuration **118** to one or more wireless devices **102** to initiate the monitoring and authorization of executable instructions **124** on that device.

Executable instruction control module **130** may include information repository **136** for storing logs **120** received from wireless device **102** based on executing authorization configuration **118**. Information repository **136** may include any type of memory or storage device.

Executable instruction control module **130** may comprise analyzer **142** operable to analyze logs **120** and generate a wireless device executable instruction analysis report **154** viewable by operator **108**. Analyzer **142** may further include hardware and analysis logic **144**, such as decision-making routines, statistical programs, and combinations thereof, for analyzing and interpreting logs **120**. Furthermore, in addition to making the full analysis report **154** available to an authorized user, the executable instruction control module **130** may be operable to generate an E-mail, comprising a message including portions of report **154**, to a device, such as the operator communication device **106**.

Referring to FIG. **6**, the executable instruction control module **130** may comprise a user manager device control module **146** operable, by execution of control logic **276**, to receive/generate control command **126**, either locally or remotely, and either execute control command **126** on wireless device **102** or transmit control command **126** to wireless device **102**. In one aspect, for example, control command **126** may contain an operator or user identification ("ID") **260** and a control activity **262**. Operator ID **260** may be some manner of identifying the originator of control command **126**, i.e. operator **108**. For example, operator ID **260** may be a name, a number, a digital signature, a hash, or any other type of data or value that may be associated with a party. Further, operator ID **260** may not be explicitly contained in the control command **126**, but rather may be derived from the origin of control command **126**.

Control activity **262** may be the operation to be performed on wireless device **102** by executable instruction authorization module **114** through executing control command **126**. As mentioned above, these operations may include downloading authorization configuration **118**, deleting executable instructions, disabling executable instructions, and restoring disabled executable instructions. Before executing or forwarding the control command **126**, user manager device control module **146** may execute permission logic **264** to verify an intent to perform the action, as well as to determine the authenticity or authority of the user issuing control command **126**. For example, a verification **265** may be obtained in response to a prompt to user manager **104**, operator **108**, and/or whomever issued the command to confirm whether the issuer actually wishes to execute control activity **262** on wireless device **102**. Further, for example, to determine an authorization **267**, permission logic **264** may parse operator ID **260** and control activity **262** from control command **126** and utilize a database of a plurality of user IDs **270** correlated with a plurality of control permissions **268**, and correlated with a plurality of wireless device identifications (IDs) **272**. Thus, based upon whether verification **265** is received and/or whether proper authorization **267** is found, device control module **146** generates a permission decision **152**, which determines whether or not to execute the given control command **126**.

Control permissions **268** may identify one or more authorized control activities **262** for a given operator ID **260** and/or wireless device IDs **272**. For instance, certain operators may be restricted to certain control activities, or to being able to control certain wireless devices. It should be noted, however, that the plurality of operator IDs **270**, the plurality of control permissions **268** and the plurality of wireless device identifications (IDs) **272** may be correlated in any manner. For example, control command **126** may contain a user ID **260** of an operator **108**, and a control activity **262** of "disable executable instructions" for a particular one of the plurality of wireless device identifications **272**. Permission logic **264** searches the database of control permissions **268** and user IDs **270** to determine if the operator **108** was permitted to disable executable instructions on the given wireless device **102**.

The actual location of the disclosed components of the executable instruction control module **130** is non-limiting and may be physically located on a server or other device connected to wireless network **110**.

Referring to FIG. **7**, an aspect of an operator communication device **106** staffed by an operator **108** to review authorization report **154** and approve unauthorized wireless executable instructions **124**. Executable instructions not approved by operator **108** may be treated as a virus.

Operator communications device **106** may comprise an input mechanism **290**, and an output mechanism **292** interconnected to a computer platform **294**. The input mechanism **290** and the output mechanism **292** may be similar to their respective counterparts **182**, **184** on wireless device **102**. The operator computer platform **294** may further comprise a memory **296** for storing applications and data files, a processing engine **308**, and a communications module **310** operable to transmit and receive messages and data between the operator position **106**, the user manager **104**, wireless device **102**, as well as any network component on wireless network **110**.

Memory **296** may comprise an operator control module **298** made executable by processing engine **308**. As the number of operator communication devices **106** and the number of operators **108** are non-limiting, an operator identification ("ID") parameter **306** may be entered into memory **296** by operator **108** and may be operable to identify the operator of the operator communication device **106** to network components including the user manager **104** and the wireless device **102**.

The operator control module **298** may further include authorization logic **300** operable in conjunction with Graphic User Interface (GUI) logic **302**, input mechanism **290**, and output mechanism **292**, to guide the operator through any analysis and command activity selection and transmission. The GUI logic **236** may control, for example, e-mail communication, report presentation, as well providing a menu for selecting and transmitting any control command **126** to the user manager **130** and wireless device **102**.

Although the operator of operator communication device **106** may be a person, as represented by operator **108** in the aspect of FIG. **1**, operator **108** may be a computing device comprising hardware, software, executable instructions, data, and combinations thereof for analyzing and responding to report **154** or to an external communication such as from the user of the wireless device **102**. Such software may include algorithms, decision-making routines, statistical programs, etc. for analyzing and interpreting report **154**. Further, as with the executable instruction control module **130**, the operator communication device **106**, as well as the computing device **106** associated with operator **108**, may reside on any network device of wireless network **110**, such as on user manager **104**, another server connected to the network, or even on a wireless device **102**.

Wireless network **110** includes any communications network operable, at least in part, for enabling wireless communications between wireless device **102** and any other device connected to wireless network **110**. Further, wireless network **110** may include all network components, and all connected devices that form the network. For example, wireless network **110** may include at least one, or any combination, of: a cellular telephone network (as embodied in FIG. **8**); a terrestrial telephone network; a satellite telephone network; an infrared network such as an Infrared Data Association ("IrDA")-based network; a short-range wireless network; a Bluetooth® technology network; a ZigBee® protocol network; an ultra wide band ("UWB") protocol network; a home radio frequency ("HomeRF") network; a shared wireless access protocol ("SWAP") network; a wideband network, such as a wireless Ethernet compatibility alliance ("WECA") network, a wireless fidelity alliance ("Wi-Fi Alliance") network, and a 802.11 network; a public switched telephone network; a public heterogeneous communications network, such as the Internet; a private communications network; and land mobile radio network.

Suitable examples of telephone networks include at least one, or any combination, of analog and digital networks/technologies, such as: code division multiple access ("CDMA"), wideband code division multiple access ("WCDMA"), universal mobile telecommunications system ("UMTS"), advanced mobile phone service ("AMPS"), time division multiple access ("TDMA"), frequency division multiple access ("FDMA"), orthogonal frequency division multiple access ("OFDMA"), global system for mobile communications ("GSM"), single carrier ("1X") radio transmission technology ("RTT"), evolution data only ("EV-DO") technology, general packet radio service ("GPRS"), enhanced data GSM environment ("EDGE"), high speed downlink data packet access ("HSPDA"), analog and digital satellite systems, and any other technologies/protocols that may be used in at least one of a wireless communications network and a data communications network.

Referring to FIG. **8**, an aspect of a cellular wireless network **320** comprises at one wireless device **102** and a cellular telephone wireless network **338** connected to a wired network **330** via a carrier network **334**. Cellular telephone system **320** is merely exemplary and can include any system whereby remote modules, such as wireless devices **102** communicate packets including voice and data over-the-air between and among each other and/or between and among components of wireless network **338**, including, without limitation, wireless network carriers and/or servers.

According to system **320**, user manager module **322** may communicate over a wired network **330** (e.g. a local area network, LAN) with data repository **324** for storing authorization information, such as the data logs **326**, gathered from the wireless device **102**. Further, a data management server **328** may be in communication with user manager module **322** to provide post-processing capabilities, data flow control, etc. User manager module **322**, data repository **324** and data management server **330** may be present on the cellular telephone system **320** along with any other network components needed to provide cellular telecommunication services.

User manager module **322**, and/or data management server **328** may communicate with carrier network **334** through data links **332** and **336**, such as the Internet, a secure LAN, WAN, or other network. Carrier network **334** controls messages (generally being data packets) sent to a mobile switching center ("MSC") **340**. Further, carrier network **334** communicates with MSC **340** by a network **336**, such as the Internet, and/or POTS ("plain old telephone service"). Typically, in network **336**, a network or Internet portion transfers data, and the POTS portion transfers voice information. MSC **340** may be connected to multiple base stations ("BTS") **344** by another network **342**, such as a data network and/or Internet portion for data transfer and a POTS portion for voice information. BTS **344** ultimately broadcasts messages wirelessly to the wireless devices, such as wireless device **102**, by short messaging service ("SMS"), or other over-the-air methods.

Referring to FIG. **9**, an aspect of a method **348** for scanning and authorizing executable instructions on a wireless device includes, at step **350**, obtaining an executable instruction authorization module. In one aspect, obtaining includes loading at least a portion of executable instruction authorization module **114** on a computer platform **112** of a wireless device **102**. For example, the executable instruction authorization module **114** may be provided during the manufacture of the device **102**. Alternatively, the executable instruction authorization module **114** may be "pushed" by a executable instruction control module **130** to the wireless device **102** or "pulled" from a executable instruction control module **130** by the wireless device **102** across a wireless network **110** depending, for example, on whether or not the wireless device **102** has the latest version of the executable instruction authorization module **114** for the respective wireless device **102**. In another alternative, the pushing or pulling of the executable instruction authorization module **114** to the wireless device **102** may be configurable in any manner, for example: being initiated by a predetermined event.

Once the executable instruction authorization module **114** has been obtained by wireless device **102**, at least a portion of authorization configuration **118** may be obtained at step **352**. For example, authorization configuration **118** may be loaded into memory **186**. Authorization configuration **118** may be provided during the manufacture of the device **102**, may be "pushed" by a executable instruction control module **130** to the wireless device **102**, or may be "pulled" from a executable instruction control module **130** by the wireless device **102**, across a wireless network **110**. The obtaining of authorization configuration **118** may be initiated in any manner, for example, being initiated by a predetermined event, such as upon activation, upon power up of the device, upon receiving new executable instructions, and a upon predetermined schedule and/or interval.

Further at step **352**, the authorization logic **116** may parse the authorization configuration **118** to determine operating parameters including: tracking parameter **188**; reporting parameter **190**; action parameter **192**; and authorization schema **194**, as discussed in detail above.

At step **354**, the authorization logic **116** may run as a background process, scanning and analyzing downloaded executable instructions **124** based upon the parsed parameters of the authorization configuration **118**.

Optionally, at step **356**, depending upon action parameter **192**, the executable instruction authorization module **114** may be operable to automatically execute a function on executable instructions identified as unauthorized. For example, action parameter **192** may include definitions of unauthorized executable instructions and corresponding definitions of actions to take in the event of detection of the unauthorized executable instructions. For instance, embodiments of action parameters **192** may include automatically deleting or disabling the executable instructions considered to be suspect or unauthorized based upon the application of the authorization schema **194**.

At step **358**, the method includes forwarding log **120** for analysis. For example, embodiments may include executable instruction authorization module **114**, based upon reporting parameter **190**, forwarding the log **120** to a remote device for further analysis. In one aspect, for example, log **120** may be uploaded from wireless device **102** to executable instruction control module **130**. Such an uploading mechanism may include a standard HTTP, an FTP, or other data transfer protocol. In other aspects, the log **120** may be transferred from the wireless device **102** using any communication means or connection to which the wireless device **102** has access.

At step **360**, the method may further include receiving, optionally verifying and/or authorizing, and executing a control command. For example, wireless device control module **122** may execute the command immediately, or wireless device control module **122** may query the source of control command **126** to verify the control command before executing it. In another example, the device control module **122** may utilize permission logic **264** to check user ID **260** and/or control activity **262** associated with control command **126** against a permissions database to determine an authorization **267** for the control command, thereby formulating permission decision **152**. In yet another alternative, device control module **122** may request user manager **104** to operate user manager device control module **146** to verify and/or authorize control command **126**. Optionally, the executable instruction authorization module **114** may log the action taken and transmit a message to the user manager **104** and/or the operator **108** indicating the success or failure of the requested action.

Referring to FIG. **10**, an example of a method **368** that provides for remote authorization of executable instructions **124** on wireless device **102** comprises, at step **370**, forwarding a executable instruction authorization module **114** to manage the executable instruction authorization functionality described herein. In one option, executable instruction authorization module **114** is installed into the device memory at the time of manufacture. In another option, because wireless device **102** may not have a executable instruction authorization module **114** pre-installed in memory, a device, such as user manager **104**, may forward executable instruction authorization module **114** to wireless device **102** through mechanisms such as a wired connection, or over an air interface using standard protocols, such as HTTP, FTP, or some other data transfer protocol.

Furthermore, at step **372**, the method includes generating and forwarding an authorization configuration **118** to the wireless device **102**. In one aspect, a user such as a technician or operator **108** may access executable instruction control module **130** and execute configuration generator module **140** to generate authorization configuration **118** for a given wireless device **102**. For example, the given wireless device **102** may not have an authorization configuration **118**, or the existing configuration **118** on the wireless device **102** may require updating or replacement. In any case, configuration generator module **140** may utilize configuration logic **254** to determine and/or customize the various parameters that comprise authorization configuration **118**, and these parameters may vary depending on the type/make/model of the wireless device **102**, the actual network service provider, and the type of executable instructions **124**.

As such, in some embodiments, executable instruction control module **130** may transmit authorization configuration **118** across wireless network **110** to wireless device **102**. In another aspect, authorization configuration **118** may be forwarded through a static or serial connection to wireless device **102**, or may be preloaded on wireless device **102** during the manufacture of the wireless device **102**.

Further, method **368** may include receiving, at step **374**, log **120** from wireless device **102**. For example, embodiments include executable instruction control module **130** receiving log **120** generated at step **354** of the method **348** embodied in FIG. **9**. In another aspect, log **120** may be received whole, or in pieces and assembled by executable instruction control module **130**. In one aspect, executable instruction control module **130** may receive log **120** over wireless network **110**, whereas another aspect may have the executable instruction control module **130** receive log **120** through a static or serial connection to the wireless device **102**, or from some other computer device or storage media in communication with user manager **130** and wireless device **102**.

Further, this aspect of method **368** may include analyzing, at step **376**, log information **120**, and generating, at step **378**, an authorization report **154** based upon that analysis. At step **378** the user manager module may transmit the report **154** to a user, such as operator **108** for further analysis and action. Log analysis may be performed by analyzer **142** and may be based upon a authorization schema similar to the authorization schema **194** disclosed as part of authorization configuration **118**. Report **154** may include any form of output that represents analysis of log **120** and other information contained in the information repository **136**, as well as any other associated information such as reports of viruses, proper executable instruction versions for the wireless device **102**, shut-down times for improper executable instruction versions, etc.

Although executable instruction control module **130** may generate report **154**, module **130** and its corresponding components may be operable to present a ready view of executable instruction authorization related information collected from the wireless devices **102** in any form, such as tables, maps, graphics views, plain text, interactive programs or web pages, or any other display or presentation of the data. For example, executable instruction control module **130** may present executable instruction authorization related information on a monitor or display device, and/or may transmit this information, such as via electronic mail, to another computer device for further analysis or review through such mechanisms as through a standard HTTP, HTTPS, an FTP, or some other data transfer protocol.

The executable instruction control module **130** may be operable to change the authorization configuration **118** on the wireless device **102** and/or send a control command **126** to be executed on the respective wireless device **102** based upon the results of analyzer **140** without further analysis or authorization by an operator **108**. Alternatively, the user manager **130** may be configured so as not to take independent action on any executable instructions determined to be unauthorized without approval from another source, such as that provided by an approved operator **108**.

In one aspect, at step **380**, the method includes providing access to the report. For example, executable instruction control module **130** may transmit report **154** to computer device **106** for review by operator **108**. Based on report **154**, operator **108** may execute an action, such as sending a control command **126** to the executable instruction control module **130** to delete or otherwise disable the executable instructions **124** on the wireless device **102**.

Optionally, at step **382** the method may include receiving, processing, and logging the control command **126**, before forwarding the command to the respective wireless device **102**.

Optionally, step **380** may include verifying a control command **126**, such as that received from operator **108** and executable on a wireless device to delete executable instructions **124**. User manager control module **146** may execute permission logic **264** to make permission decision **152** as to whether or not to transmit control command **126** to the respective wireless device **102**.

Alternatively, the operator **108**, under control of operator control module **298** and communications module **214**, may transmit the control command **126** directly to the wireless device **102**, thereby minimizing message traffic between network components.

As deletion of executable instructions may be permanent, the user manger module **130** may, at step **384**, receive a request for verification/authorization of command **126** from the wireless device prior to the execution of control command **126**. Based upon permission logic **264**, plurality of control permission **268**, plurality of user ID **270**, and plurality of wireless devices ID **272**, the unit manager module **130** may, at step **386**, transmit a verification/authorization message to the wireless device **102**.

Thus, the described aspects allow a party, such as a wireless network service provider and a wireless device manufacturer, to maintain the presence or operability of authorized executable instructions on a wireless device.

The various illustrative logics, logical blocks, modules, and circuits described in connection with the aspects disclosed herein may be implemented or performed with a general purpose processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array (FPGA) or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general-purpose processor may be a microprocessor, but, in the alternative, the processor may be any conventional processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing devices, e.g., a combination of a DSP and a microprocessor, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration.

Further, the steps of a method or algorithm described in connection with the aspects disclosed herein may be embodied directly in hardware, in a software module executed by a processor, or in a combination of the two. A software module may reside in RAM memory, flash memory, ROM memory, EPROM memory, EEPROM memory, registers, a hard disk, a removable disk, a CD-ROM, or any other form of storage medium known in the art. An exemplary storage medium is coupled to the processor, such that the processor can read information from, and write information to, the storage medium. In the alternative, the storage medium may be integral to the processor. The processor and the storage medium may reside in an ASIC. The ASIC may reside in a user terminal. In the alternative, the processor and the storage medium may reside as discrete components in a user terminal.

While the foregoing disclosure shows illustrative aspects and/or aspects, it should be noted that various changes and modifications could be made herein without departing from the scope of the described aspects and/or aspects as defined by the appended claims. Furthermore, although elements of the described aspects may be described or claimed in the singular, the plural is contemplated unless limitation to the singular is explicitly stated. Additionally, all or a portion of any aspect and/or aspect may be utilized with all or a portion of any other aspect and/or aspect, unless stated otherwise.

What is claimed is:

1. A wireless communication device, comprising:

a memory comprising executable instructions, a device type corresponding to wireless device, and an authorization configuration having an authorization schema that identifies at least one of authorized executable instructions and unauthorized executable instructions, wherein the authorization schema determines if the executable instructions are authorized or unauthorized based on the device type; and

an executable instruction authorization module resident in the memory, the executable instruction authorization module comprising authorization logic operable to scan the memory and generate a log based upon the authorization configuration, the log comprising an identification of the executable instructions determined to be unauthorized based upon the authorization schema.

2. The device of claim **1**, wherein the executable instructions comprises at least one of applications files and data files.

3. The device of claim **1**, wherein the authorization configuration is received by the wireless device from across a wireless network.

4. The device of claim **1**, wherein the authorization schema comprises a predetermined test and a predetermined result, and wherein the executable instruction authorization module is operable to execute the predetermined test to generate a test result, and further operable to compare the predetermined result to the generated test result to determine an authorization of the executable instructions.

5. The device of claim **4**, wherein the authorization schema comprises at least one of a redundancy check, a test for a predetermined value at a predetermined location within the executable instructions, a check of signature information, and a test for a predetermined result of applying a predetermined function to at least a portion of the executable instructions.

6. The device of claim **1**, wherein the executable instruction authorization module is operable to transmit the generated log to another device to determine whether or not the executable instructions are authorized.

7. The device of claim **6**, wherein the executable instruction authorization module is operable to transmit the generated log across a wireless network.

8. The device of claim **1**, wherein the generated log comprises at least one of an application name, an application version, an application creation date/time stamp, an application creator, a data file version, a data file size, and a data file creation date/time stamp.

9. The device of claim **1**, wherein the authorization configuration comprises an action parameter that identifies an action to take when a predetermined unauthorized executable instruction is discovered by the authorization logic.

10. The device of claim **1**, wherein the authorization configuration further comprises at least one of a tracking parameter selected from a plurality of tracking parameters and a reporting parameter selected from a plurality of reporting parameters, wherein the tracking parameter identifies when to scan the executable instructions, and wherein the reporting parameter identifies when to transmit the log across a wireless network.

11. The device of claim **1**, wherein the executable instruction authorization module is further operable to establish a limited-access communications channel across the wireless network, wherein the limited-access communications channel is based on a predefined limited service configuration.

12. The device of claim **11**, wherein the limited-access communications channel is not available to an end user of the device.

13. The device of claim **1**, further comprising a device control module operable to execute a control command to change a status of the executable instructions.

14. The device of claim **13**, wherein the device control module is operable to receive the control command from across a wireless network.

15. The device of claim **13**, wherein the control command comprises at least one of a disable command, a delete command, and a restore command, wherein the disable command makes the executable instructions non-operable, wherein the restore command makes disabled executable instructions operational, and wherein the delete command effectively removes the executable instructions from the wireless device.

16. The device of claim **13**, wherein the device control module is operable to verify an intent to execute the control command before executing the control command.

17. The device of claim **13**, wherein the control command comprises a user identification and a control activity, and wherein the device control module further comprises permission logic operable to determine an authorization for executing the control command based on at least one of the user identification and the control activity.

18. The device of claim **13**, wherein the log comprises an action record of executed control commands.

19. The device of claim **1**, wherein the executable instruction authorization module is operable to monitor wireless device resource utilization of the executable instructions based upon the authorization schema.

20. An apparatus for managing executable instructions on a wireless device, comprising:

a configuration generator operable to generate and transmit an authorization configuration for receipt by a wireless device, the authorization configuration comprising an authorization schema that identifies at least one of authorized executable instructions and unauthorized executable instructions, wherein the authorization schema determines if the executable instructions are authorized or unauthorized based upon a device type associated with the wireless device;

an information repository operable to receive and store a log, the log comprising unauthorized executable instructions on the wireless device based on the authorization configuration; and

an executable instruction control module comprising an analyzer operable to generate an authorization report based on the log.

21. The apparatus of claim **20**, wherein the analyzer further comprises a predetermined authorization test and a predetermined authorization result, wherein the log comprises an authorization test result generated by the wireless device, and wherein the analyzer is operable to compare the generated authorization test result to the predetermined authorization result to generate the authorization report.

22. The apparatus of claim **20**, wherein the authorization schema comprises a predetermined authorization result selected for the wireless device.

23. The apparatus of claim **22**, wherein the authorization schema comprises at least one of an application name, an application version, an application creation date/time stamp, an application creator, a data file version, a data file size, and a data file creation date/time stamp.

24. The apparatus of claim **20**, wherein the executable instruction control module is operable to transmit at least a portion of the authorization report across a wireless network for analysis.

25. The apparatus of claim **24** further comprising a user manager module is operable to select the authorization schema from a plurality of authorization schemas and operable to transmit the authorization configuration across a wireless network.

26. The apparatus of claim **20**, wherein the executable instruction control module is operable to allow an authorized user to access the authorization report.

27. The apparatus of claim **20**, further comprising a device control module operable to send a control command to change an operational characteristic of executable instructions on the wireless device.

28. The apparatus of claim **27**, wherein the device control module further comprises permission logic operable to verify an intent to execute the control command before sending the control command.

29. The apparatus of claim **27**, wherein the control command comprises a user identification and a control activity, and wherein the device control module further comprises permission logic operable to determine an authorization for executing the control command before sending the control command, the authorization based, on at least one of the user identification and the control activity.

30. The apparatus of claim **27**, wherein the device control module is operable to receive the control command from another computer device.

31. The apparatus of claim **30**, wherein the other computer device is located across a wireless network.

32. The apparatus of claim **20**, wherein the authorization configuration further comprises at least one of a tracking parameter selected from a plurality of tracking parameters, a reporting parameter selected from a plurality of reporting parameters, and an action parameter selected from a plurality of action parameters, wherein the tracking parameter dictates when to apply the authorization schema to executable instructions on the wireless device, wherein the reporting parameter identifies when to transmit the log across a wireless network, and wherein the action parameter identifies an action to take when a predetermined unauthorized executable instruction is discovered.

33. The apparatus of claim **32**, wherein the tracking parameter identifies when to scan wireless device resources and correlate resource activity with application operation.

34. A method of managing executable instructions on a wireless device, comprising:

generating an authorization configuration executable to initiate scanning and logging of executable instructions resident on a wireless device, the authorization configuration comprising an authorization schema that identifies at least one of authorized executable instructions and unauthorized executable instructions, wherein the authorization schema determines if the executable instructions are authorized or unauthorized based upon a device type associated with the wireless device;

forwarding the authorization configuration for receipt by the wireless device;

receiving a generated log from the wireless device based on the authorization configuration; and

generating an authorization report based on the received log.

35. The method of claim **34**, further comprising transmitting at least a portion of the authorization report to another computer device.

36. The method of claim **34**, further comprising sending a control command to the wireless device, where the control command is based on the authorization report and is operable to initiate an action selected from the group consisting of a delete, a disable and a restore of executable instructions on the wireless device.

37. The method of claim **36**, further comprising verifying the control command before sending the control command to the wireless device.

38. The method of claim **36**, further comprising determining whether or not the control command is authorized.

39. The method of claim **38**, where the control command comprises a user identification and a control activity, and where determining whether or not the control command is authorized further comprises comparing at least one of the user identification and the control activity with a plurality of control permissions correlated with a plurality of user identifications.

40. The method of claim **34**, further comprising selecting the authorization schema from a plurality of authorization schemas based on at least one of a type of the wireless device, an identity of a network service provider associated with the wireless device, and a type of the executable instructions.

41. A method of managing executable instructions on a wireless device, comprising:

obtaining an authorization configuration comprising an authorization schema that identifies at least one of authorized executable instructions and unauthorized executable instructions, wherein the authorization schema determines if the executable instructions are authorized or unauthorized based upon a device type associated with the wireless device;

scanning executable instructions based upon the authorization configuration;

logging at least portions of the scanned executable instructions into a log based upon the authorization schema; and

forwarding the log to another device to determine a disposition of the logged executable instructions.

42. The method of claim **41**, further comprising analyzing the scanned executable instructions based on a authorization schema, wherein the authorization schema includes at least one of a redundancy check, a test for a predetermined value at a predetermined location within the scanned executable instructions, a check of signature information, and a test for a predetermined result of applying a predetermined function to at least a portion of the scanned executable instructions.

43. The method of claim **41**, wherein the authorization schema is selected from a plurality of authorization schemas based on at least one of a type of the wireless device, an identity of a network service provider associated with the wireless device, and a type of the executable instructions.

44. The method of claim **41**, wherein receiving the authorization configuration further comprises receiving at least one of a tracking parameter selected from a plurality of tracking parameters, a reporting parameter selected from a plurality of reporting parameters, and an action parameter selected from a plurality of action parameters.

45. The method of claim **41**, further comprising establishing a limited-access communications channel across a wireless network based on a predefined limited service configuration.

46. The method of claim **41**, further comprising receiving a control command, the control command dictation at least one of deleting executable instructions and disabling executable instructions, where the control command is based on the log.

47. A machine-readable medium comprising instructions which, when executed by a machine, cause the machine to perform operations comprising:

obtaining an authorization configuration comprising an authorization schema that identifies at least one of authorized executable instructions and unauthorized executable instructions, wherein the authorization schema determines if the executable instructions are authorized or unauthorized based upon a device type associated with the wireless device;

scanning executable instructions based upon the authorization configuration;

logging at least portions of the scanned executable instructions into a log based upon the authorization schema; and

forwarding the log to another device to determine a disposition of the logged executable instructions.

48. At least one processor configured to perform the actions of:

obtaining an authorization configuration comprising an authorization schema that identifies at least one of authorized executable instructions and unauthorized executable instructions, wherein the authorization schema determines, if the executable instructions are authorized or unauthorized based upon a device type associated with the wireless device;

scanning executable instructions based upon the authorization configuration;

logging at least portions of the scanned executable instructions into a log based upon the authorization schema; and

forwarding the log to another device to determine a disposition of the logged executable instructions.

49. A wireless device, comprising:

means for obtaining an authorization configuration comprising an authorization schema that identifies at least one of authorized executable instructions and unauthorized executable instructions, wherein the authorization schema determines if the executable instructions are authorized or unauthorized based upon a device type associated with the wireless device;

means for scanning executable instructions based upon the authorization configuration;

means for logging at least portions of the scanned executable instructions into a log based upon the authorization schema; and

means for forwarding the log to another device to determine a disposition of the logged executable instructions.

50. A machine-readable medium comprising instructions which, when executed by a machine, cause the machine to perform operations comprising:

generating an authorization configuration executable to initiate scanning and logging of executable instructions resident on a wireless device, the authorization configuration comprising an authorization schema that identifies at least one of authorized executable instructions and unauthorized executable instructions, wherein the authorization schema determines if the executable instructions are authorized or unauthorized based upon a device type associated with the wireless device;

forwarding the authorization configuration for receipt by the wireless device;

receiving a generated log from the wireless device based on the authorization configuration; and

generating an authorization report based on the received log.

51. At least one processor configured to perform the actions of:

generating an authorization configuration executable to initiate scanning and logging of executable instructions resident on a wireless device, the authorization configuration comprising an authorization schema that identifies at least one of authorized executable instructions and unauthorized executable instructions, wherein the authorization schema determines if the executable instructions are authorized or unauthorized based upon a device type associated with the wireless device;

forwarding the authorization configuration for receipt by the wireless device;

receiving a generated log from the wireless device based on the authorization configuration; and

generating an authorization report based on the received log.

52. An apparatus, comprising:

means for generating an authorization configuration executable to initiate scanning and logging of executable instructions resident on a wireless device, the authorization configuration comprising an authorization schema that identifies at least one of authorized executable instructions and unauthorized executable instructions, wherein the authorization schema determines if the executable instructions are authorized or unauthorized based upon a device type associated with the wireless device;

means for forwarding the authorization configuration for receipt by the wireless device;

means for receiving a generated log from the wireless device based on the authorization configuration; and

means for generating an authorization report based on the log.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

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INVENTOR(S) : Jha et al.

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 20, line 57, claim 2: “comprises” to read as --comprise--

Column 21, line 33, claim 11: “the wireless network,” to read as --a wireless network,--

Column 22, line 59, claim 29: “based, on” to read as --based on--

Column 24, line 7, claim 42: “a authorization schema,” to read as --the authorization schema,--

Column 24, line 43, claim 47: “the wireless device;” to read as --a wireless device;--

Column 24, line 60, claim 48: “the wireless device;” to read as --a wireless device;--

Signed and Sealed this
Twelfth Day of July, 2011

David J. Kappos

David J. Kappos
Director of the United States Patent and Trademark Office